N Guidelines for Corn Silage and Grain

With high fertilizer prices and concerns about nutrient loss to the environment, it is important to account for all nutrient sources when determining the optimum nitrogen (N) application rate for both grain and silage corn. This fact sheet explains how to derive N guidelines for corn silage and grain and provides example calculations.

Corn Equations

Cornell N guidelines for corn (NetN) consider a soil specific yield index (YI), YI multipliers (A or B), annual N contribution from the soil organic matter (SoilN in lbs N/acre), N release from a decomposing sod (SodN in lbs N/acre), soil specific fertilizer N uptake efficiency (N_eff, %), soybean N credits (SoyN, lbs N/acre) and cover crop N credits (CCN, lbs N/acre):

Grain NetN (lbs/acre) =
(YI_corngrain*A–SoilN–SodN)/(N_eff/100)
–SoyN–CCN

Silage NetN (lbs/acre)=
(YI_cornsilage*B–SoilN–SodN)/(N_eff/100)
–SoyN–CCN

The Cornell yield and soils database with book values for YI, SoilN, and Neff can be found at: Yield and Soil Database. For a description of N guidelines and tables for the multipliers, SodN, SoyN, and CCN, see: Nitrogen Guidelines for Field Crops in New York.

Yield Index (YI)

The yield index is a soil and drainage-specific index that reflects a realistic yield target for a field. Book values are available for each soil type in New York (see Table 1 for examples).

Table 1: Examples of soil type specific yield indices.

Soil type	Grain Corn YI		Silage Corn YI	
	bushels/acre		tons/acre	
	DR	UD	DR	UD
Howard	165	165	18.5	18.5
Hamlin	180	180	20.5	20.5
Volusia	155	145	16.5	15.5
Rhinebeck	165	150	18.0	16.5

For farms that have at least three years of corn yield data for a specific field, that yield data should be used instead of the book values for YI. With only three or four years of yield data, the lowest yielding year can be dropped from the average while tracking of yield continues. With five years of data, up to two low yielding years can be dropped to determine the 3-year average. Once five years of data are obtained, maintain a rolling average of the most recent five years with the option to drop the two lowest yielding years from the average. Yield for grain should be entered in bu/acre at 85% DM. Yield for silage is entered in tons/acre at 35% DM.

Multiplier A (Grain) or B (Silage)

The highest producing fields typically need the least amount of external N (fertilizer or manure) per unit of yield (tons or bushels). This is reflected in yield multipliers A and B.

Grain (A):
- If YI <= 155 bu/acre:1.2
- If YI 160-225 bu/acre: 1.9233-0.0047*YI
- If 230 bu/acre or more: 0.85

Silage (B):
- If YI <= 17.0 tons/acre: 11
- If YI 17.5-24.5 tons/acre: 18.013-0.4125*YI
- If YI 25.0 or more: 7.7

Soil Nitrogen (SoilN)

Soil N availability through mineralization of soil organic matter depends on soil type and drainage status. Estimates are available for SoilN under undrained (UD) and artificial drained (DR) conditions (Table 2).

Table 2: Examples of soil nitrogen for New York soils.

Soil type	Soil N Supply (SoilN)	
	lbs N per acre	
	DR	UD
Howard	70	70
Hamlin	80	80
Volusia	70	60
Rhinebeck	75	65

Sod Nitrogen (Sod N)

When a grass/legume stand is terminated, the organic N will become plant-available through mineralization and nitrification. The amount of

available N depends on stand composition, the percent of legume in the stand at termination, and time since the sod crop was terminated.

Table 3: Sod nitrogen release rates.

		Available N		
Legume in sod (%)	Total N pool	Yr 1*	Yr 2	Yr 3
	lbs N per acre			
0	150	83	18	8
1-25	200	110	24	10
26-50	250	138	30	13
50 or more	300	165	36	15

* First year following plow down.

Soil N Uptake Efficiency (N_eff)

The percentage of applied fertilizers and soil and sod N credit that can become part of the plant is called the N uptake efficiency. For most soils in New York, efficiencies range from 50 to 75% and can depend on drainage status (Table 4).

Table 4: Examples of soil nitrogen uptake efficiencies.

Soil type	N uptake efficiency (N_eff)	
	Drained	Undrained
	%	%
Howard	75	75
Hamlin	75	75
Volusia	65	60
Rhinebeck	65	60

Soybean N Credits (SoyN):

Corn that follows soybeans in a rotation needs less N than corn following corn. As a result, the optimum N rate for corn grown after soybeans can be lowered by up to 30 lbs N/acre. See Agronomy Fact Sheet 30 for details.

Cover Crop N Credits (CCN):

After an over-wintering cover crop, such as cereal rye or triticale, the N rate can be lowered by 20-30 lbs N/acre compared to corn grown no cover crop. If the cover crop is planted after small grain harvest in July/August, cover crop credits of 40-50 lbs N/acre can be applied. The N rate for corn grown after interseeded legumes can be lowered by up to 70-120 lbs N/acre.

Example Calculations

For third-year grain corn after termination of a 50% alfalfa sod on a drained Rhinebeck soil:

NetN (lbs/acre) =
*[(165*1.15)-75-13]/(65/100) = 157 lbs N/acre*

For a fourth-year silage corn following soybean in rotation on a drained Volusia soil:

NetN (lbs/acre) =
*[(18*10.6)-70-0]/(65/100)-20= 166 lbs N/acre*

Other Considerations

- First year corn after sod for fields without a recent manure history can benefit from a starter N application of 20-30 lbs N/acre.
- The N guidelines can be increased by 20 lbs/acre for a no-till crop production system due to slower soil warming in the spring.

Manure N Credits

Manure contributes N for three years. Thus, the N credits from manure applications in the three previous years must be subtracted from the NetN rate. For more information on manure N credits, see Agronomy Fact Sheet 4.

Nutrient Management Planning

New York nutrient management plans require fields to be balanced for N according to Cornell N guidelines. A feasibility factor for N-based fields not to exceed 20 lbs per acre above Cornell Crop N Guidelines is allowed on a field-by-field basis to facilitate a workable balance scenario across all fields and nutrient sources.

In Summary

Nitrogen guidelines take into account realistic yield targets, soil N, rotation credits, as well as past and current manure N credits.

Additional Resources

- Cornell Nutrient Management Spear Program Agronomy Fact Sheet Series: http://nmsp.cals.cornell.edu/guidelines/factsheets.html
- Nitrogen Guidelines for Field Crops in New York: http://nmsp.cals.cornell.edu/publications/extension/Ndoc2025.pdf

Disclaimer

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For more information

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